EFFECTS OF DIETARY FAT AND WET SORGHUM DISTILLER'S GRAINS PLUS SOLUBLES ON FEEDLOT PERFORMANCE AND CARCASS CHARACTERISTICS OF FINISHING HEIFERS

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Summary

Four hundred yearling heifers in two experiments were fed for an average of 106 days. Treatments included 0% wet sorghum distiller's grains plus solubles (WSDGS) and 0% yellow grease (fat), 0% WSDGS and 3% fat, or 15% WSDGS and either 0, 1.5, or 3% fat. The WSDGS replaced steam-flaked corn and cottonseed meal. Overall dry matter intake (DMI) was 5% greater ($P < 0.01$) for heifers fed 15% WSDGS than for those fed 0% WSDGS. Among heifers fed WSDGS, DMI was greatest for heifers fed 1.5% fat ($P = 0.04$; quadratic). Overall ADG was 5% greater ($P = 0.04$) for 15% WSDGS compared to 0% WSDGS. Among WSDGS, ADG tended to be greater for 1.5% fat ($P = 0.12$; quadratic). Feed efficiency did not differ between 0 or 3% fat when 0% WSDGS was fed, nor was feed efficiency altered by replacing a portion of flaked corn with WSDGS ($P > 0.36$). However, feed efficiency was improved as more fat was added to WSDGS diets ($P = 0.06$). Heifers fed WSDGS had a higher DMI and greater ADG than heifers fed flaked corn, but feed efficiency did not differ. Adding more than 1.5% fat to diets containing WSDGS tended to reduce growth performance.

Introduction

A growing body of information is available describing the feeding value of wet corn distiller's grains plus solubles, primarily in diets based on dry-rolled corn. In the Southern Great Plains, wet corn distiller's grains are not locally available at this time, but wet sorghum distiller's grains plus solubles are currently produced in the region.

Daubert et al. (2005) fed heifers 0, 8, 16, 24, 32 or 40% WSDGS for 58 days in diets based on steam-flaked corn without supplement fat. Feed efficiency was improved 9% for heifers fed 16% WSDGS, and efficiency became similar to the control heifers after diets contained more than approximately 24% WSDGS. Vasconcelos et al. (2007) fed steers 0, 5, 10, and 15% WSDGS in diets with added tallow. Feeding more than 10% of diet DM as WSDGS reduced cattle performance. Most Southern Plains feedlots possess the ability to include supplemental fat in the diet, and information is needed on the relative feeding value of WSDGS in diets containing added fat and steam-flaked corn.

Experimental Procedures

Four hundred yearling heifers in two experiments were fed for an average of 106 days. Heifers were processed on arrival and adapted to a common 92% concentrate diet before treatments were imposed. Processing included individual identification with a numbered ear tag, vaccination against viral pathogens (Vista 5), administration of a clostridial bacterin-toxoid (Vision 7 with Spur), pregnancy determination by rectal palpation, treatment for internal and external parasites (Ivomec Plus and Safe-Guard), horn tipping, and implanting with Revalor-H. Only nonpregnant heifers were enrolled in the study. Treatments included 0% wet sorghum distiller's grains plus solubles (WSDGS) and 0% yellow grease (fat), 0% WSDGS and 3% fat, or 15% WSDGS with either 0, 1.5, or 3% fat. The WSDGS effectively replaced a combination of 2/3 steam-flaked corn and 1/3 cottonseed meal (Table 1).

The WSDGS was obtained from the US Bioenergy plant in Portales, NM on multiple occasions and stored in 10-foot diameter silage bags throughout the study. All diets were mixed and fed once daily. Corn was processed approximately twice weekly by steaming tempered grain (19% moisture, 18-hour soak) for approximately 40 minutes before flaking to 27 lb/bu. Samples of diets were collected weekly from the bunk after feed delivery; dry matter was determined on a subsample and remaining sample was composited gravimetrically within treatment over the entire study. Dry matter of steam-flaked corn and WSDGS was determined 5 days/week and the 5-day average was used to update as-fed diet composition each week, whereas dry matter content of remaining ingredients was determined once/week. Data were analyzed as a replicated randomized complete block design using Mixed procedures of SAS. Block and experiment were considered random effects and treatment served as a fixed effect.

Results and Discussion

Two heifers died during the study, and data for the affected pens were adjusted based on average feed intake by the pen before the date of death. Diets containing WSDGS were wetter (Table 1), but were also more dense ($P < 0.01$) than the diets that did not contain WSDGS.

Heifers fed 15% WSDGS consumed approximately 5% more DM ($P < 0.05$; Table 2) than heifers fed 0% WSDGS, and DMI among heifers fed 15% WSDGS was greatest for heifers fed 1.5% fat ($P < 0.10$). Heifer ADG on both a live and carcass-adjusted basis was greater for those fed 15% WSDGS ($P < 0.05$) than for those fed 0% WSDGS, but ADG was not altered by adding fat to diets with 15% WSDGS. However, feed efficiency on either a live or carcass-adjusted basis was not different between heifers 0 and 15% WSDGS. Feed efficiency was improved in a linear manner as fat was added to diets with 15% WSDGS ($P < 0.06$). Hot carcass weight was increased an average of 11 lb ($P = 0.05$) when WSDGS replaced a portion of steam-flaked corn and cottonseed meal in the diet, but carcass weight was greatest for heifers fed WSDGS with 1.5% fat ($P = 0.09$, quadratic). Heifers fed 0% WSDGS without fat had a larger ribyea area, lower marbling score, less rib fat, and a lower yield grade ($P < 0.08$) than heifers fed 0% WSDGS with 3% fat. Heifers fed 15% WSDGS had more rib fat and a higher yield grade ($P < 0.03$) than heifers fed 0% WSDGS. Carcass quality grade distribution was not altered by treatment in the present study.

Diet energy values were determined (Table 2) based on actual cattle performance and calculated carcass fatness using the equation of Guiroy et al. (2001). The net energy values were then determined for yellow grease based on actual performance, whereas the NE values for WSDGS were determined by the process of substitution. Assuming that whole corn contains 0.68 Mcal of NEg/lb (NRC, 1996), the NEg determined for WSDGS was approximately 91% of the NEg of whole corn.

The inclusion of a wet ingredient such as WSDGS can also alter feed manufacturing and delivery needs in a commercial feedlot. Thus, projections for these needs were developed based on data generated in the present study (Figure 1). If feed trucks were loaded to the same net volume with 15% WSDGS compared to 0% WSDGS, a feedlot would need to deliver approximately 10% more loads of feed per day. If feed trucks were loaded to the same net weight, a feedlot would need to deliver approximately 23% more loads of feed per day.

Implications

Heifers fed wet sorghum distiller's grains plus solubles consumed approximately 5% more feed and gained weight approximately 5% more rapidly. However, feed efficiency was similar whether or not wet sorghum distiller's were included in the diet. The wet sorghum distiller's grains fed in the present studies replaced a blend of approximately 2/3 steam-flaked corn and 1/3 cottonseed meal. Under these conditions, the NEg value of the distiller's equated to 91% of the tabular NEg of whole corn.

Acknowledgements

This experiment was supported, in part, by a cooperative agreement the USDA-ARS and WTAMU. The mention of trade or manufacturer names is made for information only and does not imply an endorsement, recommendation, or exclusion by USDA-ARS or WTAMU. The authors gratefully acknowledge MicroBeef Technologies, Nutri-Chem, and Ferrell-Ross for providing feedmill equipment, Intervet for supplying pharmaceutical supplies, and US Bioenergy for partial donation of distiller's grains.

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Table 1. Ingredient and chemical composition of diet dry matter

	Wet sorghum distiller's grains plus solubles, %				
	0	0	15	15	15
	Yellow grease, %				
Item	0	3	0	1.5	3.0
Ingredient composition					
Steam-flaked corn	80.4	76.7	69.9	68.4	66.9
Supplement	2.6	2.6	2.6	2.6	2.6
Urea	0.9	0.9	0.9	0.9	0.9
Cottonseed meal, 41%	4.5	5.2	-	-	-
Wet sorghum distiller's plus solubles	-	-	15.0	15.0	15.0
Steep liquor:molasses (70:30)[a]	4.0	4.0	4.0	4.0	4.0
Yellow grease[b]	-	3.0	-	1.5	3.0
Alfalfa hay	4.6	4.6	4.6	4.6	4.6
Cottonseed hulls	3.0	3.0	3.0	3.0	3.0
Chemical composition					
CP, % of DM	13.5	13.5	16.0	16.0	16.0
Diet dry matter, %	83.2	83.6	67.7	67.6	67.5
Diet density, lb/cu ft	14.1[c]	14.3[c]	16.5[d]	16.6[d]	16.7[d]

[a]Propionic acid was added at 0.5% (w/w) to prevent mold growth during storage.
[b]Rendox AET (Kemin Americas, Des Moines, IA) was added at 0.1% (w/w) to prevent oxidation.
[c,d]Means differ ($P < 0.01$).

Table 2. Effect of dietary fat and wet sorghum distiller's grains plus solubles on feedlot performance and carcass characteristics of heifers and on ingredient net energy values

	Wet sorghum distiller's grains plus solubles, %					
	0	0	15	15	15	
	Yellow grease, %					
Item	0	3	0	1.5	3.0	SE[a]
DMI, lb/d[b,c]	18.28	18.36	19.21	19.83	19.25	1.61
Live ADG, lb/d[b]	3.08	3.12	3.17	3.38	3.29	0.20
Feed efficiency[d]	5.95	5.89	6.09	5.90	5.88	0.17
Adjusted ADG, lb/d[b]	3.06	3.13	3.10	3.36	3.30	0.20
Adjusted feed efficiency[d]	6.00	5.86	6.23	5.90	5.84	0.19
Hot carcass wt, lb[c]	733	737	735	754	748	24.59
Dressing, %	63.83	64.08	63.59	63.96	64.08	0.37
Longissimus area, in^2 [e]	14.6	13.80	14.12	14.11	14.22	0.28
Marbling score[f, e]	41.53	43.39	43.04	43.03	42.83	1.28
Ribfat thickness, in[b, e]	0.44	0.52	0.54	0.53	0.54	0.04
Yield grade[b, e]	2.06	2.58	2.53	2.58	2.53	0.16
≥ Low Choice, %	58.61	73.47	82.50	74.31	68.68	-
Select, %	40.14	26.53	17.50	25.60	30.07	-
Standard, %	1.25	0	0	0	1.25	-
Observed diet NEm[g], Mcal/lb	0.98	1.00	0.96	0.98	0.99	-
Observed diet NEg, Mcal/lb	0.67	0.69	0.66	0.67	0.68	-
Ingredient NE, Mcal/lb						
Yellow grease NEm[h]	-	2.15	-	2.15	2.15	-
Yellow grease NEg	-	1.59	-	1.59	1.59	-
WSDGS NEm[i]	-	-	0.94	0.93	0.92	-
WSDGS NEg	-	-	0.62	0.62	0.62	-

[a]Standard error of the least squares mean, n = 8.
[b]0 vs 15% WSDGS (P < 0.05).
[c]Quadratic effect of yellow grease among 15%WSDGS (P < 0.10).
[d]Linear effect of yellow grease among 15% yellow grease (P < 0.06).
[e]0% WSDGS, 0% yellow grease vs 0% WSDGS, 3% yellow grease (P < 0.10).
[f]Slight = 300 to 399, Small = 400 to 499, etc.
[g]Determined using the standard reference weights of 435, 462, and 478 for < 26.8, 26.8 to 27.7%, and > 27.7% empty body fat (NRC, 1996) as determined by the equation from Guiroy et al. (2001; JAS 79:1983).
[h]Actual NEm and NEg were determined by replacement of the corn + fat portion only of WSDGS-containing diets because these carcasses demonstrated similar fatness. Steam-flaked corn NE and NEg used were 1.09 and 0.766 Mcal/lb, respectively, based on a previous estimate in the same facility.
[i]Actual NEm and NEg were determined by replacement using the NE value for steam-flaked corn and yellow grease as described and assuming that cottonseed meal contained 0.81 and 0.52 Mcal/lb of NEm and NEg, respectively (NRC, 1996).

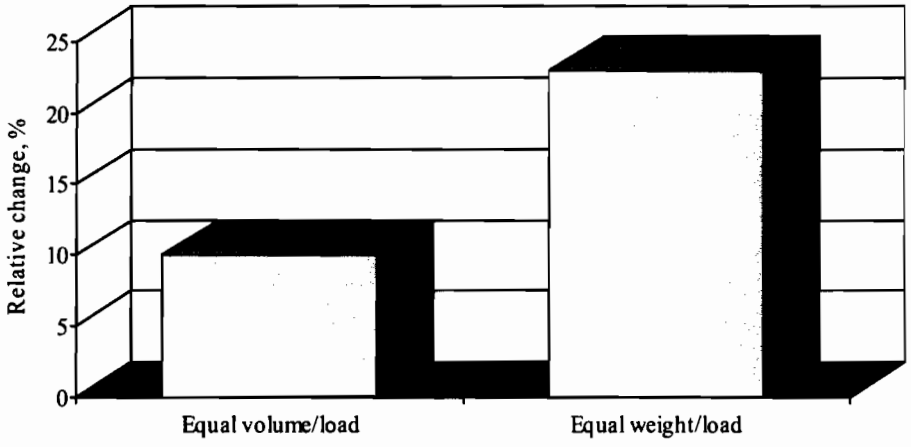
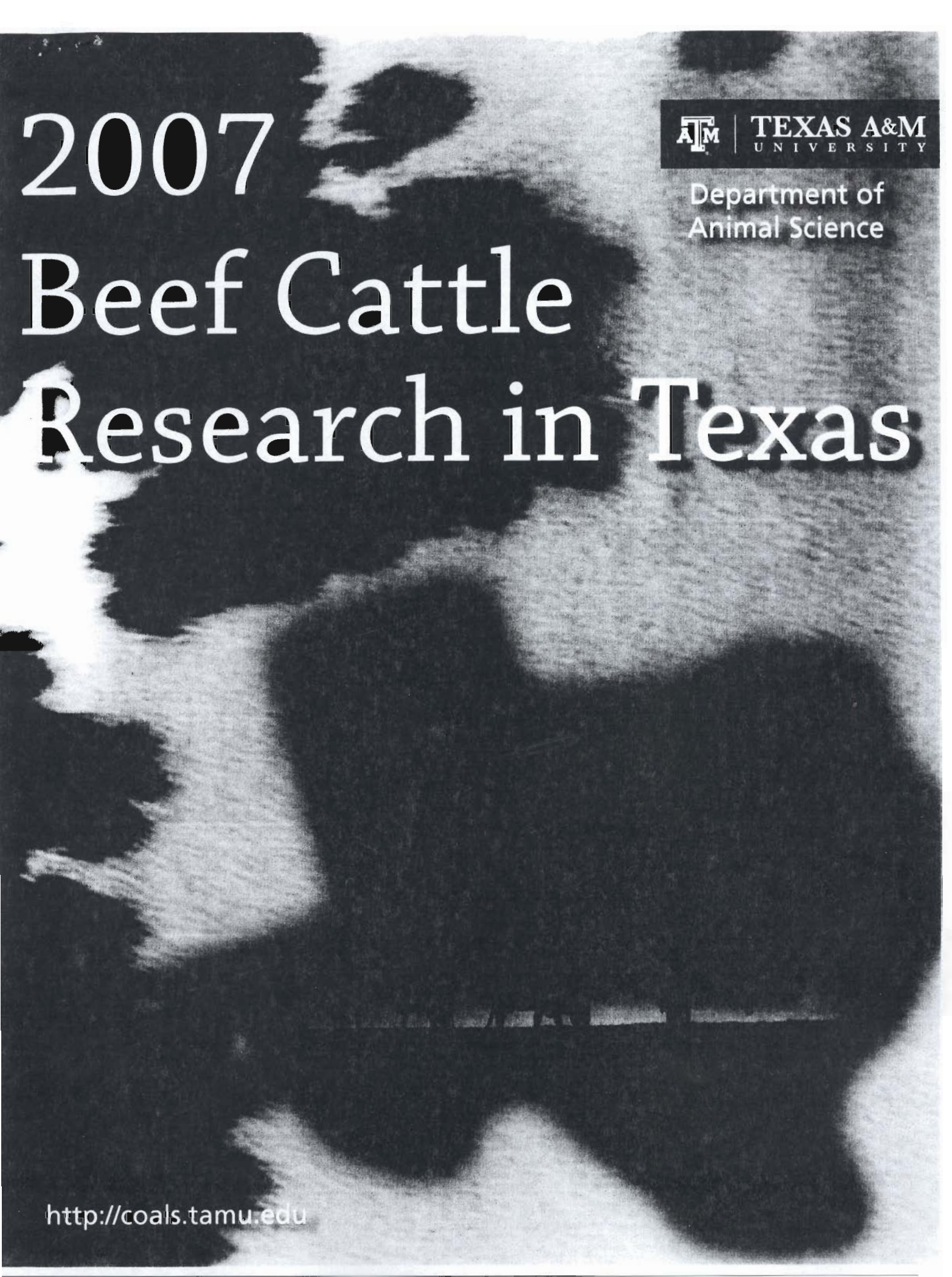


Figure 1. Increase in number of loads (900 ft^3 each) required for diets containing 15% wet sorghum distiller's grains plus solubles (WSDGS) if feed trucks are loaded to a constant volume or a constant weight/load. These data assume DMI, diet density, and diet DM of 20 lb/day, 14.2 lb/ ft^3, and 83.37%, respectively, for 0% WSDGS and 21 lb/day, 16.6 lb/ ft^3, and 67.63%, respectively, for 15% WSDGS diets.



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